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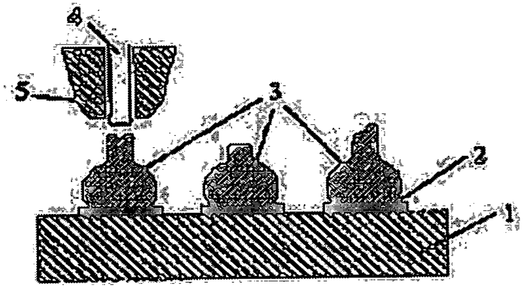
(54) CIRCUIT BOARD

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a circuit board which adhesively fixes a semiconductor chip to a board with an anisotropic conductive adhesive film and connects electrodes of both with high electric connection reliability.
SOLUTION: A semiconductor chip mounting board has conductor circuits on the surface. The semiconductor chip has bump electrodes 3 corresponding to specified regions of the conductor circuits. The entire bump electrode formed surface is tightly adhered to the board surface through adhesives to electrically connect the conductor circuits to the electrodes 3. The electrode 3 of the chip 1 uses bump electrode formed by forming a ball of the top end of a metal wire 4 by a thermal energy, welding the ball to an electrode pad 2 of the chip 1 by a capillary 5 and cutting the wire 4. The bump electrode 3 uses a ball bump formed only by cutting the wire 4 without flattening it. Hence the top end of the electrode 3 is used for connection in a softened state enough to deform the top end according to the variation of the electrode heights on the connecting board, thus absorbing this height variation and hence improving the connection reliability.



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CLAIMS

[Claim(s)]
[Claim 1] The first circuit member which has the first connection terminal, and the second circuit member which has the second connection terminal Arrange the first connection terminal and the second connection terminal face to face, and adhesives are made to intervene between said first connection terminal which carried out opposite arrangement, and the second connection terminal. It is the circuit plate to which heating pressurization was carried out and said first connection terminal and second connection terminal which carried out opposite arrangement were connected electrically. Said one [at least] connection terminal of the first connection terminal and the second connection terminal which carried out opposite arrangement The circuit plate characterized by being the projection electrode constituted by cutting the account metal wire of back to front which formed the ball for the tip of a metal wire with heat energy, and stuck this ball by pressure on the electrode pad section which a connection terminal consists of.
[Claim 2] The circuit plate according to claim 1 whose projection electrode is a projection electrode of the phase which cut the metal wire.
[Claim 3] The circuit plate according to claim 1 or 2 whose adhesives are anisotropic conductive adhesives.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the circuit plate obtained by connecting both electrodes electrically while carrying out adhesion immobilization of the semiconductor chip with a substrate and an anisotropic conductive adhesive film for example, with a face down method.
[0002]
[Description of the Prior Art] what an anisotropic conductive adhesive film becomes from the adhesives which carried out specified quantity content of the electric conduction particles, such as metal particles, -- it is -- this anisotropic conductive adhesive film -- between electronic parts, an electrode, or circuits -- preparing -- pressurization or a heating pressurization means -- ****** -- while both electrodes are electrically connected by things, contiguity inter-electrode insulation is given and adhesion immobilization of electronic parts and the circuit is carried out by them. The fundamental idea for improving the connection dependability of an anisotropic conductive adhesive film is obtaining the electric connection in a connection part by securing and combining insulation contiguity inter-electrode with making particle size of an electric conduction particle smaller than a contiguity inter-electrode tooth-space part, and making the content of an electric conduction particle into extent which this electric conduction particle does not contact, and making it certainly exist on an electrode.
[0003]
[Problem(s) to be Solved by the Invention] This invention offers the circuit plate connected with the outstanding connection dependability in the circuit plate which connected the circuit members which have a connection terminal like the circuit plate obtained by connecting both electrodes electrically while carrying out adhesion immobilization of the semiconductor chip with a substrate, an anisotropic conductive adhesive film, etc.
[0004]
[Means for Solving the Problem] The circuit plate of this invention the first circuit member which has the first connection terminal, and the second circuit member which has the second connection terminal Arrange the first connection terminal and the second connection terminal face to face, and adhesives are made to intervene between said first connection terminal which carried out opposite arrangement, and the second connection terminal. It is the circuit plate to which heating pressurization was carried out and said first connection terminal and second connection terminal which carried out opposite arrangement were connected electrically. Said one [at least] connection terminal of the first connection terminal and the second connection terminal which carried out opposite arrangement A ball is formed for the tip of a metal wire with heat energy, and it is characterized by being the projection electrode constituted by cutting the account metal wire of back to front which stuck this ball by pressure on the electrode pad section which a connection terminal consists of. As for said projection electrode, it is desirable that it is the projection electrode of the phase which cut the metal wire. Moreover, as for said adhesives, it is desirable that they are the anisotropic conductive adhesives which carried out specified quantity content of the electric conduction particles, such as metal particles.
[0005] In this invention, substrates, such as chips, such as a semiconductor chip, a resistor chip, and a capacitor chip, and a printed circuit board, etc. are used as a circuit member. Carry out opposite arrangement of some connection terminals [at least] in which the connection terminal is usually prepared in these circuit members a large number (an unit is sufficient depending on the case), and at least 1 set of said circuit member was prepared by those circuit members, and adhesives are made to intervene between the connection terminals which carried out opposite arrangement, and heating pressurization is carried out, and it connects electrically in the connection terminals which carried out opposite arrangement, and carries out

as a circuit plate. the connection terminals which carried out opposite arrangement by carrying out heating pressurization of at least 1 set of a circuit member -- direct contact -- or it connects electrically through the electric conduction particle of anisotropic conductive adhesives.

[0006]

[Embodiment of the Invention] the conductor formed in the mounting substrate front face as a desirable example of the circuit plate of this invention -- to the predetermined field on a circuit It arranges so that the protrusion electrode of a semiconductor chip may correspond, and it is made to fix so that said whole protrusion electrode forming face side front face of said semiconductor chip may stick to said mounting substrate front face through adhesives. It is the semiconductor chip mounting substrate to which a circuit and the protrusion electrode of said semiconductor chip are connected electrically. said conductor -- After each protrusion electrode prepared in said semiconductor chip forms a ball for the tip of a metal wire with heat energy and sticks said ball by pressure on the electrode pad of a semiconductor chip by the capillary, there is a semiconductor chip mounting substrate from which it comes to cut a metal wire and which is a projection electrode.

[0007] One example of this invention is explained based on drawing. Drawing 1 is the sectional view showing the making process of the letter electrode of a projection in which one example of this invention is shown, and drawing 2 is the sectional view showing the cross-section structure of the connection part when connecting a semiconductor chip to the printed circuit board of one example of this invention. First, after fixing a golden ball, adding [as shown in drawing 1 , carry out melting of the tip of the golden wire 4 on a torch etc., form a golden ball, and] energy on the aluminum electrode pad 2 of a semiconductor chip 1 by the capillary 5, the golden wire 4 is pulled and cut and the letter electrode 3 of a ball bump projection which consists of a ball and a residual wire on the aluminum electrode pad 2 of a semiconductor chip 1 is obtained. As the letter electrode 3 of a ball bump projection of the phase which pulled and cut the golden wire 4 is shown in drawing 1 , dispersion tends to produce the die length of the wire which remains in the ball upper part, and a configuration, and the height of the letter electrode 3 of a ball bump projection has become an ununiformity.

[0008] Then, as shown in Fig. 2, the printed circuit board 11 used as the letter electrode 3 of a projection of the semiconductor chip 1 in which the letter electrode 3 of a projection was formed, and the second substrate is connected with the different direction electric conduction film 21. First, after imprinting the different direction electric conduction film 21 to a printed circuit board 11, alignment with the letter electrode 3 of a projection of a semiconductor chip 1 and the electrode 12 for connection of a printed circuit board 11 is performed, heating sticking by pressure of the semiconductor chip 1 is carried out for 20 seconds with the temperature and the pressure of 180 degrees C, and 10kgf / chip, and the different direction electric conduction film 21 is stiffened. 22 is an electric conduction particle. This connection condition is held by hardening of the adhesives of a different direction electric conduction film between a semiconductor chip and a printed circuit board at the same time the letter electrode 3 of a projection of a semiconductor chip 1 and the electrode 12 for connection of a printed circuit board 11 are electrically connected through the different direction electric conduction film 21 by this.

[0009] Here, although the semiconductor chip was used as the 1st substrate, in addition to this, substrates, such as a printed circuit board besides chips, such as a resistor chip and a capacitor chip, are used. The same is said of the 2nd substrate. Moreover, although the letter electrode of a projection was formed in the semiconductor chip used as the 1st substrate here, it can also form and connect with the 2nd substrate. Furthermore, the letter electrode of a projection can be formed in both the 1st substrate and the 2nd substrate, and it can also connect with them. Although the different direction electric conduction adhesives which carried out distributed restoration of the electric conduction particle were used into adhesives as a connection ingredient here, only the adhesives which do not contain an electric conduction particle can also be used.

[0010]

[Effect of the Invention] By this invention, the circuit plate which is excellent in the connection dependability of connection terminals can be obtained. Moreover, although it was common to have used flattening, processing after the ball-like bump (letter electrode of a ball bump projection) conventionally obtained by the wire bond method cut a metal wire According to this invention, the tip of the letter electrode of a projection is used for connection in the condition with elasticity and flexibility by using for the letter electrode of a projection the ball bump (letter electrode of a ball bump projection) who does not process gradual flattening which cut the metal wire. Since the letter electrode of a projection of this condition is connected to the electrode of them and the connection substrate which counters, carrying out heating pressurization, dispersion in the electrode height of a connection substrate is followed, the tip of a projection electrode deforms, it becomes possible to absorb dispersion in this height, and improvement in connection dependability can be aimed at. Moreover, while sufficient deformation can be expected also in the pressurization in the small force and the proposal of a connection pressure is attained from the ability of the tip of the letter electrode of a projection to be made small, the damage to a chip, a substrate, etc. can be reduced.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] The sectional view showing the making process of the letter electrode of a projection in which one example of this invention is shown.
[Drawing 2] The sectional view showing the cross-section structure of the connection part when connecting a semiconductor chip to the printed circuit board of one example of this invention.
[Description of Notations]
1. Semiconductor Chip
2. Aluminum Electrode Pad
3. Letter Electrode of Ball Bump Projection
4. Golden Wire
5. Capillary
11. Printed Circuit Board 11
12. Electrode for Connection
21. Different Direction Electric Conduction Film
22. Electric Conduction Particle

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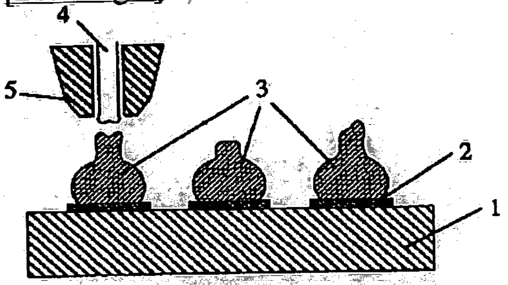
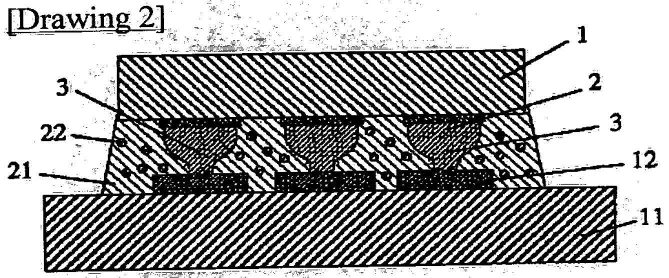
DRAWINGS

[Drawing 1]



[Drawing 2]



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最終頁に続く

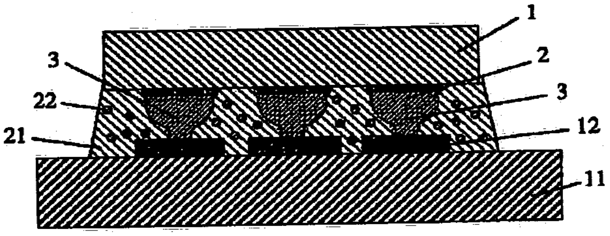
(54)【発明の名称】　回路板

(57)【要約】

【目的】　半導体チップを基板と異方導電性接着フィルムで接着固定すると共に両者の電極どうしを電気的に優れた接続信頼性で接続した回路板を提供する。

【構成】　実装基板表面に形成された導体回路上の所定の領域に、半導体チップの突出電極が対応するように配置し、半導体チップの突出電極形成面側表面全体が接着剤を介して実装基板表面に密着するように固着し、導体回路と半導体チップの突出電極とが電気的に接続される半導体チップ実装基板において、半導体チップに設けた個々の突出電極が、金属ワイヤの先端を熱エネルギによりボールを形成し、前記ボールをキャピラリにより半導体チップの電極パッド上に圧着した後、金属ワイヤを切断した突起電極を用いる。

【効果】　突起状電極に金属ワイヤを切断した段階の平坦化の処理を施さないボールバンプを用いることによって、突起状電極の先端は弾性、柔軟性を有した状態で接続に用いられ、接続基板の電極高さのばらつきに追従して突起電極の先端が変形し、この高さのばらつきを吸収することが可能となり、接続信頼性の向上が図れる。



【特許請求の範囲】

【請求項１】第一の接続端子を有する第一の回路部材と、
第二の接続端子を有する第二の回路部材とを、
第一の接続端子と第二の接続端子を対向して配置し、
前記対向配置した第一の接続端子と第二の接続端子の間に接着剤を介在させ、加熱加圧して前記対向配置した第一の接続端子と第二の接続端子を電気的に接続させた回路板であって、
前記対向配置した第一の接続端子と第二の接続端子の少なくとも一方の接続端子が、金属ワイヤの先端を熱エネルギによりボールを形成しこのボールを接続端子が構成される電極パッド部上に圧着した後前記金属ワイヤを切断して構成された突起電極であることを特徴とする回路板。

【請求項２】　突起電極が、金属ワイヤを切断した段階の突起電極である請求項１記載の回路板。

【請求項３】　接着剤が、異方導電性接着剤である請求項１又は２記載の回路板。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、例えばフェイスダウン方式により半導体チップを基板と異方導電性接着フィルムで接着固定すると共に両者の電極どうしを電気的に接続することにより得られる回路板に関する。

【０００２】

【従来の技術】異方導電性接着フィルムは、金属粒子等の導電粒子を所定量含有した接着剤からなるもので、この異方導電性接着フィルムを電子部品と電極や回路の間に設け、加圧または加熱加圧手段を構じることによって、両者の電極同士が電気的に接続されると共に、隣接電極間の絶縁性を付与して、電子部品と回路とが接着固定されるものである。異方導電性接着フィルムの接続信頼性を向上するための基本的な考えは、導電粒子の粒径を隣接電極間のスペース部分よりも小さくすることで隣接電極間の絶縁性を確保し、併せて導電粒子の含有量をこの導電粒子が接触しない程度とし、かつ電極上に確実に存在させることにより接続部分における電気的な接続を得ることである。

【０００３】

【発明が解決しようとする課題】本発明は、例えば半導体チップを基板と異方導電性接着フィルム等で接着固定すると共に両者の電極どうしを電気的に接続することにより得られる回路板のように接続端子を有する回路部材どうしを接続した回路板において、優れた接続信頼性で接続された回路板を提供するものである。

【０００４】

【課題を解決するための手段】本発明の回路板は、第一の接続端子を有する第一の回路部材と、第二の接続端子を有する第二の回路部材とを、第一の接続端子と第二の接続端子を対向して配置し、前記対向配置した第一の接続端子と第二の接続端子の間に接着剤を介在させ、加熱加圧して前記対向配置した第一の接続端子と第二の接続端子を電気的に接続させた回路板であって、前記対向配置した第一の接続端子と第二の接続端子の少なくとも一方の接続端子が、金属ワイヤの先端を熱エネルギによりボールを形成しこのボールを接続端子が構成される電極パッド部上に圧着した後前記金属ワイヤを切断して構成された突起電極であることを特徴とするものである。前記突起電極は、金属ワイヤを切断した段階の突起電極であることが好ましい。又前記接着剤は、金属粒子等の導電粒子を所定量含有した異方導電性接着剤であることが好ましい。

【０００５】本発明において、回路部材としては半導体チップ、抵抗体チップ、コンデンサチップ等のチップ部品、プリント基板等の基板等が用いられる。これらの回路部材には接続端子が通常は多数（場合によっては単数でも良い）設けられており、前記回路部材の少なくとも１組をそれらの回路部材に設けられた接続端子の少なくとも一部を対向配置し、対向配置した接続端子間に接着剤を介在させ、加熱加圧して対向配置した接続端子どうしを電気的に接続して回路板とする。回路部材の少なくとも１組を加熱加圧することにより、対向配置した接続端子どうしは、直接接触により又は異方導電性接着剤の導電粒子を介して電気的に接続する。

【０００６】

【発明の実施の形態】本発明の回路板の好ましい具体例としては、実装基板表面に形成された導体回路上の所定の領域に、半導体チップの突出電極が対応するように配置し、前記半導体チップの前記突出電極形成面側表面全体が接着剤を介して前記実装基板表面に密着するように固着せしめられ、前記導体回路と前記半導体チップの突出電極とが電気的に接続される半導体チップ実装基板であって、前記半導体チップに設けた個々の突出電極が、金属ワイヤの先端を熱エネルギによりボールを形成し、前記ボールをキャピラリにより半導体チップの電極パッド上に圧着した後、金属ワイヤを切断してなる突起電極である半導体チップ実装基板がある。

【０００７】図に基づいて本発明の一実施例を説明する。図１は、本発明の一実施例を示す突起状電極の作製工程を示す断面図であり、図２は本発明の一実施例のプリント基板へ半導体チップを接続したときの接続部分の断面構造を示す断面図である。まず、図１に示すように金ワイヤ４の先端をトーチ等により溶融させ金ボールを形成し、キャピラリ５により半導体チップ１のアルミ電極パッド２上にエネルギを加えつつ金ボールを固着した後、金ワイヤ４を引っ張って切断し、半導体チップ１のアルミ電極パッド２上にボールと残存ワイヤからなるボールバンプ突起状電極３を得る。金ワイヤ４を引っ張って切断した段階のボールバンプ突起状電極３は、図１に

示すようにボール上部に残存するワイヤの長さ、形状はばらつきが生じやすく、ボールバンプ突起状電極３の高さは不均一になっている。

【０００８】この後、第２図に示すように、突起状電極３を形成した半導体チップ１の突起状電極３と第二の基板となるプリント基板１１とを異方導電フィルム２１により接続する。まず、プリント基板１１に異方導電フィルム２１を転写した後、半導体チップ１の突起状電極３とプリント基板１１の接続用電極１２との位置合せを行い、半導体チップ１を１８０℃、１０ｋｇｆ／チップの温度及び圧力により２０秒間加熱圧着して異方導電フィルム２１を硬化させる。２２は導電粒子である。これによって、異方導電フィルム２１を介して半導体チップ１の突起状電極３とプリント基板１１の接続用電極１２とを電気的に接続されると同時に半導体チップとプリント基板間は異方導電フィルムの接着剤の硬化によって、この接続状態を保持する。

【０００９】ここでは、第１の基板として半導体チップを用いたがその他に抵抗体チップ、コンデンサチップ等のチップ部品のほか、プリント基板等の基板が用いられる。第２の基板も同様である。また、ここでは突起状電極を第１の基板となる半導体チップに形成したが、第２の基板に形成して接続することもできる。さらに、第１の基板及び第２の基板双方に突起状電極を形成して接続することもできる。ここでは接続材料として接着剤中に導電粒子を分散充填した異方導電接着剤を用いたが、導電粒子を含まない接着剤のみを用いることもできる。

【００１０】

【発明の効果】本発明により、接続端子どうしの接続信頼性に優れる回路板を得ることができる。又、従来ワイ

ヤボンド方式で得られるボール状バンプ（ボールバンプ突起状電極）は、金属ワイヤを切断した後平坦化の処理を施して使用することが一般的であったが、本発明によれば、突起状電極に金属ワイヤを切断した段階の平坦化の処理を施さないボールバンプ（ボールバンプ突起状電極）を用いることによって、突起状電極の先端は弾性、柔軟性を有した状態で接続に用いる。この状態の突起状電極をそれらと対向する接続基板の電極に加熱加圧しながら接続するため、接続基板の電極高さのばらつきに追従して突起電極の先端が変形し、この高さのばらつきを吸収することが可能となり、接続信頼性の向上が図れる。また、突起状電極の先端を小さくできることから、小さな力での加圧においても十分な変形が期待でき、接続圧力の提言が可能となると同時に、チップ、基板等へのダメージを低減できる。

【図面の簡単な説明】

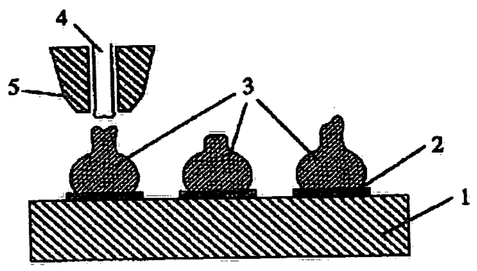
【図１】本発明の一実施例を示す突起状電極の作製工程を示す断面図。

【図２】本発明の一実施例のプリント基板へ半導体チップを接続したときの接続部分の断面構造を示す断面図。

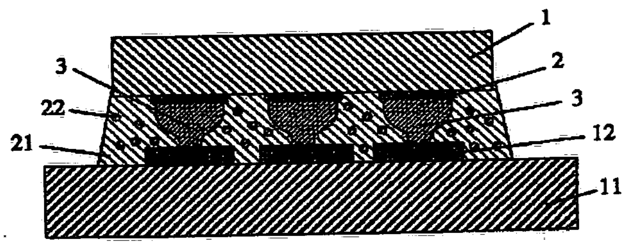
【符号の説明】

１．半導体チップ
２．アルミ電極パッド
３．ボールバンプ突起状電極
４．金ワイヤ
５．キャピラリ
１１．プリント基板１１
１２．接続用電極
２１．異方導電フィルム
２２．導電粒子

【図１】



【図２】



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